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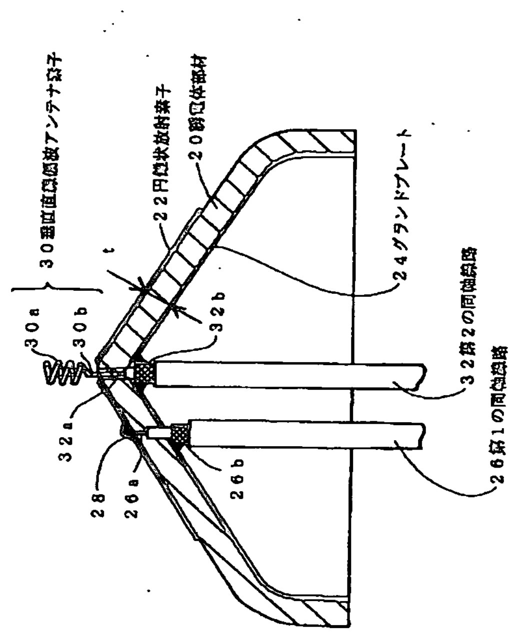
(54)【発明の名称】　複合アンテナ

(57)【要約】

【課題】衛星波と地上波の双方で送信される放送信号を受信し、衛星波に対して仰角の違いにより利得の変化が少なくまた低仰角でも利得が大きく、さらに地上波に対して低仰角の利得が大きい複合アンテナを提供する。

【解決手段】上方に凸なる円錐状で厚さが略一定な誘電体部材２０の表面に、錐状の頂点を中心として円錐状放射素子２２を配設し、誘電体部材２０の裏面にグランドプレート２４を配設し、円錐状放射素子２２に裏面側より第１の同軸線路２６の中心導体２６ａを電気的接続して、誘電体部材２０を挟んで円錐状放射素子２２とグランドプレート２４で、円偏波を受信し得る円偏波受信パッチアンテナを形成する。第１の同軸線路２６の外部導体２６ｂはグランドプレート２４に電気的接続する。また、誘電体部材２０の錐状の頂点に、ヘリカルコイルを含んで形成されて垂直直線偏波を受信し得る垂直直線偏波受信アンテナ素子３０を上方に突設して配設する。



【特許請求の範囲】

【請求項１】　円偏波の衛星波と垂直直線偏波の地上波を受信する複合アンテナであって、上方に凸なる錐状で厚さが略一定な誘電体部材の表面に、前記錐状の頂点を中心として錐状放射素子を配設し、前記誘電体部材の裏面にグランドプレートを配設し、前記錐状放射素子に給電線を接続して前記錐状放射素子とグランドプレートで前記円偏波を受信し得る円偏波受信パッチアンテナを形成し、前記誘電体部材の前記錐状の頂点に上方に突設して前記垂直直線偏波を受信し得る垂直直線偏波受信アンテナ素子を前記錐状放射素子と絶縁状態で配設して構成したことを特徴とする複合アンテナ。

【請求項２】　請求項１記載の複合アンテナにおいて、前記誘電体部材を円錐状とし、その表面に円錐状の前記錐状放射素子を配設し、前記垂直直線偏波受信アンテナ素子をヘリカルコイルを含んで構成したことを特徴とする複合アンテナ。

【請求項３】　請求項１または２記載の複合アンテナにおいて、前記錐状放射素子に、前記グランドプレート側から前記誘電体部材を貫通して前記給電線としての第１の同軸構造の中心導体を電気的接続し、前記第１の同軸構造の外部導体を前記グランドプレートに電気的接続し、前記垂直直線偏波受信アンテナ素子の基端を、第２の同軸構造の中心導体に電気的接続し、前記第２の同軸構造の外部導体を前記グランドプレートに電気的接続して構成したことを特徴とする複合アンテナ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、アメリカ本土で放送が開始されるＸＭサテライトラジオ放送およびシリウスサテライト放送などの、衛星波と地上波の双方で送信される放送信号をともに受信するための複合アンテナに関するものである。

【０００２】

【従来の技術】衛星から送信される衛星波と、これを地上局で受信して変調方式を相違させて再び地上局から送信される地上波とを、ともに受信する従来の複合アンテナの一例を、図９を参照して説明する。

【０００３】図9は、従来の複合アンテナの一例の斜視図である。図9において、誘電体板１０の表面に矩形の面状放射素子１２が配設され、誘電体板１０の裏面にグランドプレート１４が配設され、面状放射素子１２に裏面側から誘電体板１０を貫通した給電線（図示せず）が電気的接続され、面状放射素子１２とグランドプレート１４により衛星から送信される円偏波の衛星波を受信する円偏波受信パッチアンテナ１６が構成されている。また、面状放射素子１２の中心位置に、上方に突設してヘリカルコイルを含んで構成されて垂直直線偏波の地上波を受信する垂直直線偏波受信アンテナ素子１８が配設される。なお、垂直直線偏波受信アンテナ素子１８は、面状放射素子１２とは絶縁状態にある。

【０００４】かかる構成の従来の複合アンテナの指向特性は、図１０ないし図１２のごときである。図１０は、円偏波受信パッチアンテナ１６で衛星波を受信した垂直面内指向特性図である。図１１は、垂直直線偏波受信アンテナ素子１８で地上波を受信した垂直面内指向特性図である。図１２は、垂直直線偏波受信アンテナ素子１８で地上波を受信した水平面内指向特性図である。

【０００５】

【発明が解決しようとする課題】図９に示す従来の複合アンテナにあっては、図１２に示すごとく、地上波に対して水平面内指向特性は無指向性を示している。また、図示してないが、衛星波に対して水平面内指向特性が無指向性を示すことは勿論である。しかるに、図１０に示すごとく、衛星波に対して、垂直上方の利得が最も大きく、仰角が低くなるほど利得が低下する。これは受信する場所によりまた複合アンテナが設置される姿勢などにより受信感度に変化を生ずることとなる。そして、図１１に示すごとく、地上波に対して、水平方向の低仰角における利得が小さい。地上波に対して良好な受信感度を得るためには、水平方向の低仰角の利得が大きいことが望ましい。

【０００６】本発明は、上述のごとき従来技術の事情に鑑みてなされてもので、衛星波に対して仰角の違いにより利得の変化が少なくまた低仰角でも利得が大きく、さらに地上波に対して低仰角の利得がより大きくなるように改善した複合アンテナを提供することを目的とする。

【０００７】

【課題を解決するための手段】かかる目的を達成するために、本発明の複合アンテナは、円偏波の衛星波と垂直直線偏波の地上波を受信する複合アンテナであって、上方に凸なる錐状で厚さが略一定な誘電体部材の表面に、前記錐状の頂点を中心として錐状放射素子を配設し、前記誘電体部材の裏面にグランドプレートを配設し、前記錐状放射素子に給電線を接続して前記錐状放射素子とグランドプレートで前記円偏波を受信し得る円偏波受信パッチアンテナを形成し、前記誘電体部材の前記錐状の頂点に上方に突設して前記垂直直線偏波を受信し得る垂直直線偏波受信アンテナ素子を前記錐状放射素子と絶縁状態で配設して構成されている。

【０００８】そして、前記誘電体部材を円錐状とし、その表面に円錐状の前記錐状放射素子を配設し、前記垂直直線偏波受信アンテナ素子をヘリカルコイルを含んで構成しても良い。

【０００９】また、前記錐状放射素子に、前記グランドプレート側から前記誘電体部材を貫通して前記給電線としての第１の同軸構造の中心導体を電気的接続し、前記第１の同軸構造の外部導体を前記グランドプレートに電気的接続し、前記垂直直線偏波受信アンテナ素子の基端を、第２の同軸構造の中心導体に電気的接続し、前記第

２の同軸構造の外部導体を前記グランドプレートに電気的接続して構成することもできる。
【００１０】
【発明の実施の形態】以下、本発明の第１実施例を図１ないし図６を参照して説明する。図１は、本発明の複合アンテナの第１実施例の外観図であり、（ａ）は平面図、（ｂ）は側面図である。図２は、図１の（ａ）のＡ－Ａ断面矢視拡大図である。図３は、円偏波受信パッチアンテナで衛星波を受信した垂直面内指向特性図である。図４は、垂直直線偏波受信アンテナ素子で地上波を受信した垂直面内指向特性図である。図５は、垂直直線偏波受信アンテナ素子で地上波を受信した水平面内指向特性図である。図６は、図１の複合アンテナをアンテナ収容筐体に収容した縦断面図である。
【００１１】本発明の複合アンテナにあっては、上方に凸なる円錐状で厚さｔが略一定な誘電体部材２０の表面に、導電金属板や導電金属薄膜などからなる円錐状の円錐状放射素子２２が配設される。誘電体部材２０の頂点を中心として円錐状放射素子２２が配設され、その頂点は一致する。そして、円錐状放射素子２２の縁には、放射状に対向する２箇所に切り欠き状の摂動素子２２ａ，２２ａが設けられる。また、誘電体部材２０の裏面略全面に導電金属薄膜などからなるグランドプレート２４が配設される。さらに、第１の同軸線路２６の中心導体２６ａが裏面側から誘電体部材２０を貫通して、表面にある円錐状放射素子２２に半田付け２８などにより適宜に電気的接続される。また、第１の同軸線路２６の外部導体２６ｂは、グランドプレート２４に適宜に半田付けなどにより電気的接続される。もって、誘電体部材２０を挟んで設けられた円錐状放射素子２２とグランドプレート２４により、円錐状の円偏波受信パッチアンテナが形成される。なお、一例として、ＸＭサテライトラジオ放送の送信周波数の２．３ＧＨｚの円偏波の衛星波を受信するための円錐状放射素子２２は、その頂角が１２５°であり、頂点から縁までの寸法は２５mmである。この円錐状放射素子２２の受信周波数に対する外形寸法は、誘電体部材２０の誘電率により適宜に設定すべきことは勿論である。
【００１２】さらに、誘電体部材２０の円錐状の頂点に、上方に突設してヘリカルコイル部３０ａとその基端側が直線部３０ｂとされる垂直直線偏波受信アンテナ素子３０が配設される。直線部３０ｂが誘電体部材２０の頂点を垂直方向に貫通し、裏面側に設けられる第２の同軸線路３２の中心導体３２ａに電気的接続される。この第２の同軸線路３２の外部導体３６ｂは、誘電体部材２０の裏面のグランドプレート２４に半田付けなどにより適宜に電気的接続される。なお、この垂直直線偏波受信アンテナ素子３０は、円錐状放射素子２２に対して絶縁された状態とされている。そして、垂直直線偏波受信アンテナ素子３０は、グランドプレート２４より上方の部分がアンテナとして作用し、一例として、共振させるように放送の送信周波数の２．３ＧＨｚの１／４波長の電気長に設定される。
【００１３】かかる構成の本発明の複合アンテナにあっては、図３に示すごとく、衛星波に対して、円錐状放射素子２２で受信した垂直面内指向特性は、垂直上方から略±７０°の低い仰角まで受信感度はほぼ５ｄＢと略同一であり、しかも±９０°の低仰角にあっても、－５ｄＢと、図１０に示す従来の複合アンテナに比較して、略３ｄＢほど利得が向上している。そこで、衛星波に対して、これを受信する場所や本発明の複合アンテナが設置される姿勢により受信感度の変化が少ない。しかも、低仰角における受信感度が向上している。もって、衛星波を確実に受信し得る。なお、衛星波に対する水平面内指向特性は、図示していないが、無指向性であることは勿論である。
【００１４】そして、図４に示すごとく、地上波に対して、垂直直線偏波アンテナ素子３０で受信した垂直指向特性は、±９０°の低仰角においてほぼ１ｄＢと、図１１に示す従来の複合アンテナに比較して、略３ｄＢほど利得が向上している。これにより、地上波に対して略３ｄＢほど受信感度の向上が図れている。
【００１５】ここで、垂直直線偏波アンテナ素子３０に対して、円錐状放射素子２２は反射板として作用することから、この反射板を頂角の小さな円錐状とすることで±９０°の低仰角の利得が改善されるものと考えられるが、円錐状放射素子２２の頂角を１８０°から単に減少させても、垂直直線偏波アンテナ素子３０の±９０°の低仰角の利得が一律に向上するものではなく、増加と減少が交互に生ずる。そこで、発明者らは、反射板としての円錐状放射素子２２の頂角を、実験により１２５°に設定している。
【００１６】上述のごとき本発明の複合アンテナは、一例として車の屋根などに搭載できるように、図６に示すごとく、アンテナ収容筐体に収容される。図６において、誘電体部材２０の基部側に回路基板４０が配設され、この回路基板４０には衛星波および地上波の受信信号を増幅する低雑音増幅回路（図示せず）が搭載され、第１と第２の同軸線路２６，３２の他端が回路基板４０に適宜に電気的接続されて、受信信号が低雑音増幅回路に入力される。そして、この低雑音増幅回路の増幅出力は、出力ケーブル４２により導出される。また、複合アンテナを上から覆うように略円錐状の誘電体からなるレドーム４４が設けられ、複合アンテナの下側には基台４６が配設される。レドーム４４と基台４６により、水密的に複合アンテナを収容し得るアンテナ収容筐体４８が構成される。さらに、基台４６が適宜に車の屋根に貼着などにより適宜に固定され得る。
【００１７】次に、本発明の第２実施例を図７を参照して説明する。図７は、本発明の複合アンテナの第２実施

例の外観斜視図である。図７に示す第２実施例では、四角錐状で厚さが略一定な誘電体部材５０の表面に、その頂点を一致させて導電金属板や導電金属薄膜などからなる四角錐状放射素子５２が配設される。そして、誘電体部材５０の頂点に上方に突出させてヘリカルコイルを含む垂直直線偏波受信アンテナ素子３０が配設される。なお、誘電体部材５０の裏面には図示しないグランドプレートが設けられ、また四角錐状放射素子５２にも適宜な給電線が電気的接続されて、円偏波受信パッチアンテナが形成される。

【００１８】図７に示す本発明の第２実施例にあっても、第１実施例と同様に、衛星波および地上波に対してともに低仰角の利得の向上が図れる。

【００１９】さらに、本発明の第３実施例を図８を参照して説明する。図８は、本発明の複合アンテナの第３実施例の外観図であり、（ａ）は平面図、（ｂ）は正面図である。図８に示す第３実施例で、第１実施例と相違するところは、円錐状放射素子２２に対する給電線を、第１の同軸線路２６に代えて、誘電体部材２０の表面に設けた帯状の導電金属薄膜などからなるマイクロストリップライン６０で形成したものである。第１実施例と同様の作用効果が得られることは勿論である。

【００２０】なお、上述の第１実施例では、第１と第２の同軸線路２６，３２を用いているが、同軸構造が形成されれば、いかなる構造のものであっても良い。また、第１実施例のごとく、円錐状の誘電体部材２０の表面に平面投影形状が円形の円錐状放射素子２２が設けられるものに限られず、平面投影形状が矩形（正方形および長方形を含む）のものや正方形の１つの隅が切り欠かれたものなどであっても良い。また、第２実施例のごとく、四角錐状の誘電体部材５０の表面に平面投影形状が矩形の四角錐状放射素子５２が設けられるものに限られず、平面投影形状が円形の錐状放射素子であっても良い。そして、第２実施例で、誘電体部材およびその表面に配設される錐状放射素子は、四角錐に限られず、五角錐や六角錐などいかなる角錐状であっても良い。さらに、誘電体部材は、楕円錐状や長方形の四角錐などであっても良い。誘電体部材２０、５０の表面に設けられる錐状放射素子は、その平面投影形状が円偏波を受信し得るいかなるパッチ形状であっても良い。さらに、実施例では、垂直直線偏波受信アンテナ素子３０は、物理的長さを短くするためにヘリカルコイルを含んで形成されているが、物理的長さが長くても良ければポールアンテナで形成しても良いことは勿論であり、水平面内指向性が無指向なアンテナであればいかなる構造のものであっても良い。

【００２１】

【発明の効果】以上説明したように本発明の複合アンテナは構成されているので、以下のごとき格別な効果を奏する。

【００２２】請求項１記載の複合アンテナにあっては、円偏波受信パッチアンテナを形成する放射素子を錐状としたことにより、衛星波を円偏波受信パッチアンテナで受信した垂直面内指向特性の低仰角において、および地上波を垂直直線偏波受信素子で受信した垂直面内指向特性の低仰角におけるいずれでも利得が改善される。しかも、衛星波に対して垂直上方から略±７０°の低い仰角までの広い範囲で利得はほぼ一定である。そこで、衛星波に対して、これを受信する場所や複合アンテナの姿勢の変化などにより、受信感度が大幅に変化することがない。

【００２３】請求項２記載の複合アンテナにあっては、全体を略円錐状に形成し、その頂点に物理的長さが短いヘリカルコイルを含んだ垂直直線偏波受信アンテナ素子を突設するので、全体を小型に構成するのに好適である。

【００２４】請求項３記載の複合アンテナにあっては、円偏波受信パッチアンテナおよび垂直直線偏波受信アンテナ素子による受信信号を、第１と第２の同軸構造で導出するので、受信信号の導出経路における減衰を生じることがない。

【図面の簡単な説明】

【図１】本発明の複合アンテナの第１実施例の外観図であり、（ａ）は平面図、（ｂ）は側面図である。

【図２】図１の（ａ）のＡ－Ａ断面矢視拡大図である。

【図３】本発明の複合アンテナの円偏波受信パッチアンテナで衛星波を受信した垂直面内指向特性図である。

【図４】本発明の複合アンテナの垂直直線偏波受信アンテナ素子で地上波を受信した垂直面内指向特性図である。

【図５】本発明の複合アンテナの垂直直線偏波受信アンテナ素子で地上波を受信した水平面内指向特性図である。

【図６】図１の複合アンテナをアンテナ収容筐体に収容した縦断面図である。

【図７】本発明の複合アンテナの第２実施例の外観斜視図である。

【図８】本発明の複合アンテナの第３実施例の外観図であり、（ａ）は平面図、（ｂ）は正面図である。

【図９】従来の複合アンテナの一例の斜視図である。

【図１０】従来の複合アンテナの円偏波受信パッチアンテナで衛星波を受信した垂直面内指向特性図である。

【図１１】従来の複合アンテナの垂直直線偏波受信アンテナ素子で地上波を受信して垂直面内指向特性図である。

【図１２】従来の複合アンテナの垂直直線偏波受信アンテナ素子で地上波を受信した水平面内指向特性図である。

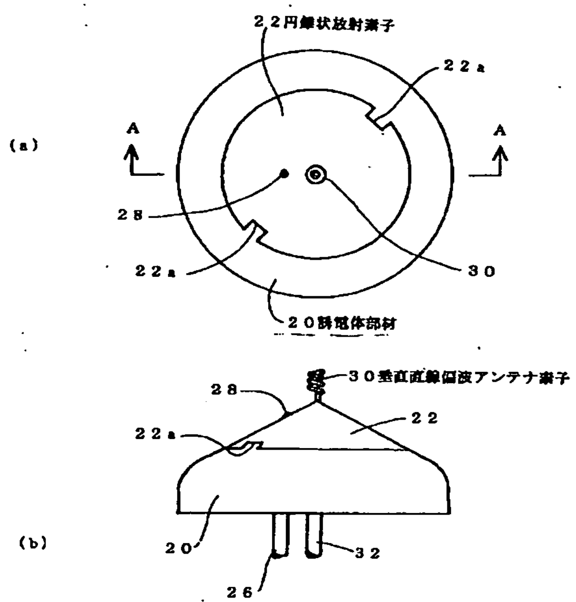
【符号の説明】

１４、２４　グランドプレート

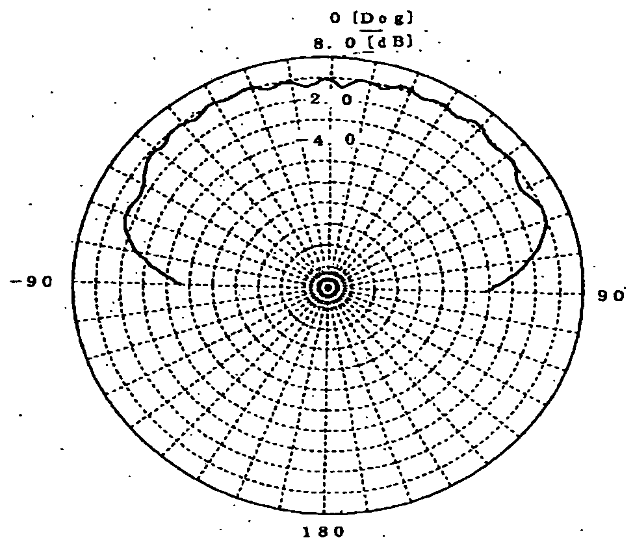
１８、３０　垂直直線偏波受信アンテナ素子

２０、５０　誘電体部材
２２　円錐状放射素子
２６　第１の同軸線路
３２　第２の同軸線路
５２　四角錐状放射素子
６０　マイクロストリップライン

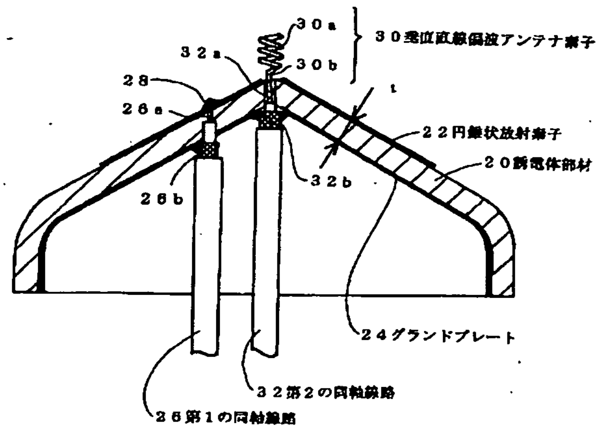
【図１】



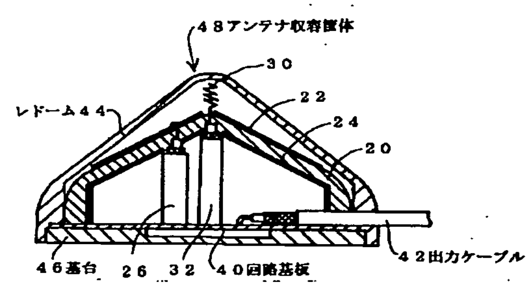
【図３】



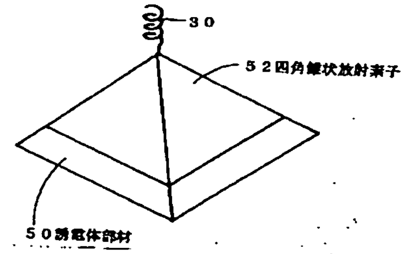
【図２】



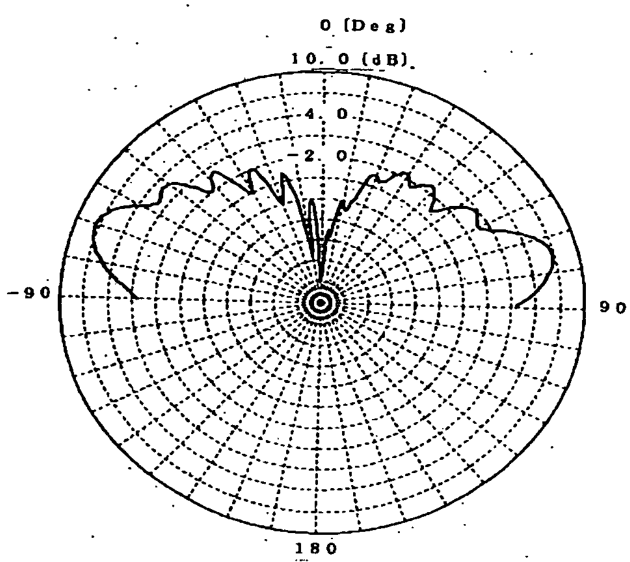
【図６】



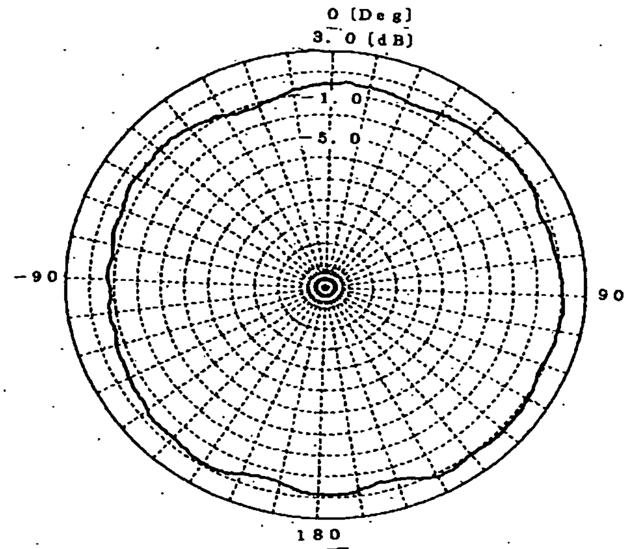
【図７】



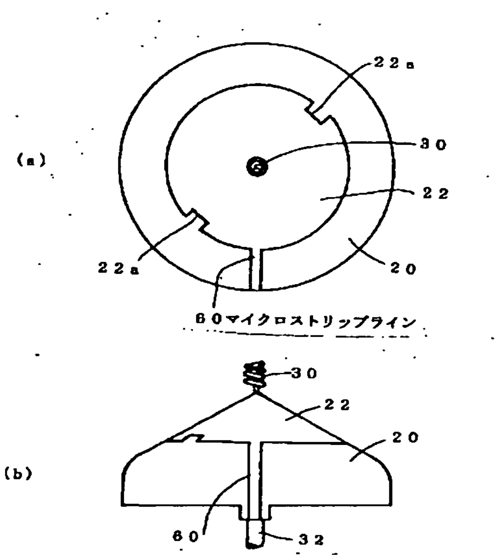
【図4】


0 [Deg]
10. 0 [dB]
-4. 0
-2. 0
-90
90
180

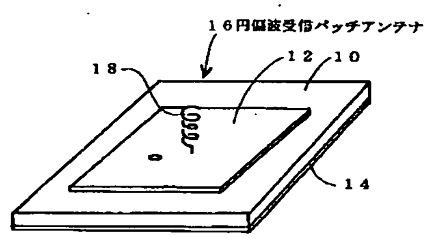
【図5】


0 [Deg]
3. 0 [dB]
-1. 0
-5. 0
-90
90
180

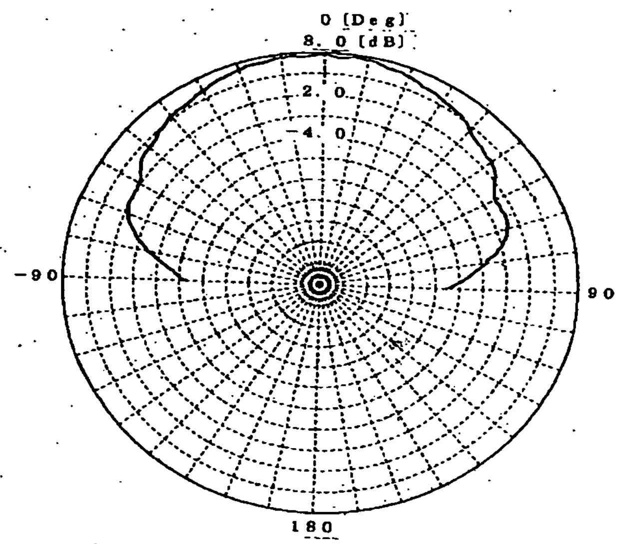
【図8】


(a)
22a
30
22
20
22a
60マイクロストリップライン
(b)
30
22
20
60
32

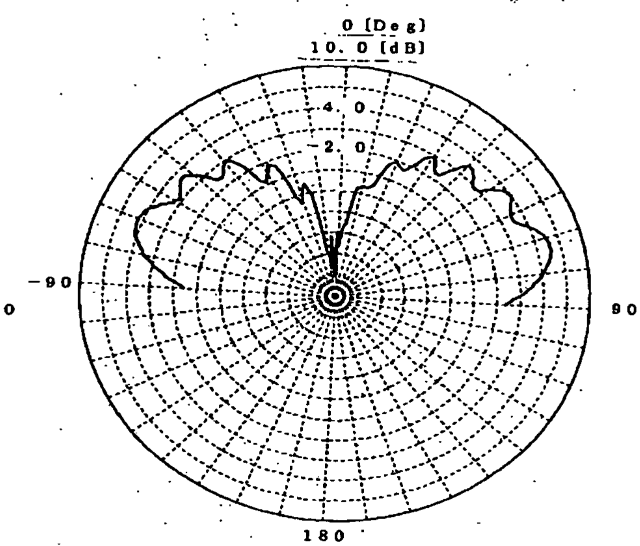
【図9】


16円偏波受信パッチアンテナ
18
12
10
14

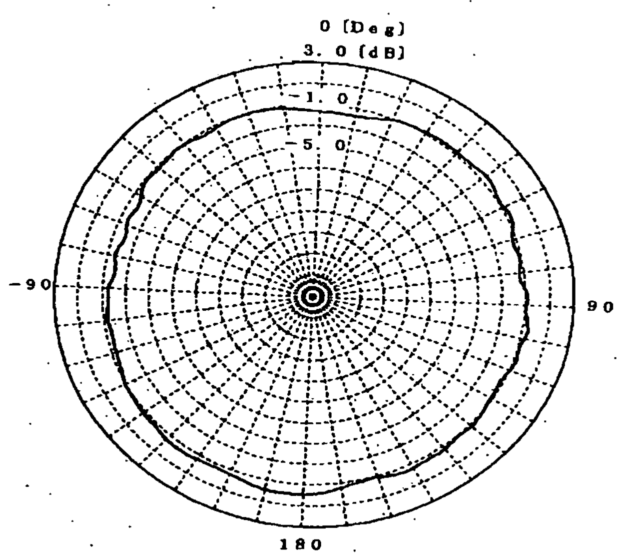
【図１０】



【図１１】



【図１２】



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PA07

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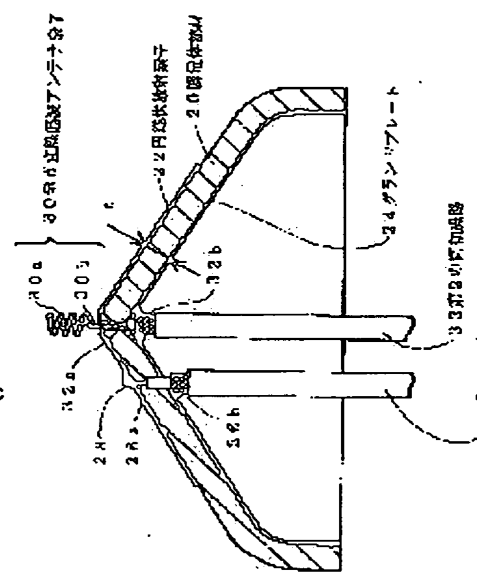
UCHIDA HARUHISA

(54) COMPOSITE ANTENNA

(57)Abstract:



PROBLEM TO BE SOLVED: To provide a composite antenna which receives broadcasting signals transmitted by both of satellite waves and ground waves, for which the change of a gain is less by the difference of an elevation angle and the gain is large even at low elevation angle for the satellite waves and the gain at the low elevation angle is large for the ground waves.

SOLUTION: On the surface of the dielectric member 20 of roughly fixed thickness in a conical shape projected upwards, a conical radiation element 22 is disposed with the vertex of the conical shape as a center. A ground plate 24 is disposed on the back surface of the dielectric member 20. The center conductor 26a of a first coaxial line 26 is electrically connected from the back surface side to the conical radiation element 22 and a circularly polarized wave receiving patch antenna capable of receiving circularly polarized waves is formed of the conical radiation element 22 and the ground plate 24 holding the dielectric member 20 there between. The outer conductor 26b of the first coaxial line 26 is electrically connected to the ground plate 24. Also, at the vertex of the conical shape of the dielectric member 20, a vertical linearly polarized wave receiving antenna element 30 formed including a helical coil and capable of receiving vertical linearly polarized waves is projected upwards and disposed.

LEGAL STATUS

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[Date of registration]
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CLAIMS

[Claim(s)]
[Claim 1] It is the compound antenna which receives a satellite wave of a circularly-polarized wave, and a ground wave of a perpendicular linearly polarized wave. A drill-like radiating element is arranged in the surface of a fixed dielectric member centering on top-most vertices of the shape of said drill. the upper part -- a convex -- the shape of a drill -- thickness -- abbreviation -- A circularly-polarized-wave reception patch antenna which arranges a grand plate in a rear face of said dielectric member, connects a feeder to said drill-like radiating element, and can receive said circularly-polarized wave on said drill-like radiating element and grand plate is formed. A compound antenna characterized by having arranged a perpendicular linearly polarized wave receiving-antenna element which protrudes on top-most vertices of the shape of said drill of said dielectric member up, and can receive said perpendicular linearly polarized wave in the state of said drill-like radiating element and the insulation, and constituting it.
[Claim 2] A compound antenna characterized by having made said dielectric member into the shape of a cone, having arranged said conic drill-like radiating element in the surface in a compound antenna according to claim 1, and constituting said perpendicular linearly polarized wave receiving-antenna element including a helical coil.
[Claim 3] In a compound antenna according to claim 1 or 2 to said drill-like radiating element Penetrate said dielectric member from said grand plate side, and electrical installation of the central conductor of the 1st coaxial structure as said feeder is carried out. Electrical installation of the outer conductor of said 1st coaxial structure is carried out to said grand plate. A compound antenna which carries out electrical installation of the end face of said perpendicular linearly polarized wave receiving-antenna element to a central conductor of the 2nd coaxial structure, and is characterized by having carried out electrical installation of the outer conductor of said 2nd coaxial structure to said grand plate, and constituting it.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention relates to the compound antenna for receiving both the broadcast signals transmitted on the both sides of satellite waves, such as the XM Satellite Radio broadcast by which broadcast is started in a U.S. mainland, and the Sirius satellite broadcast, and a ground wave.
[0002]
[Description of the Prior Art] An example of the conventional compound antenna which both receives the satellite wave transmitted from a satellite and the ground wave which receive this in an earth station, and a modulation technique is made different, and is again transmitted from an earth station is explained with reference to drawing 9 .
[0003] Drawing 9 is the perspective diagram of an example of the conventional compound antenna. In drawing 9 , the rectangular field-like radiating element 12 is arranged in the surface of the dielectric board 10, the grand plate 14 is arranged in the rear face of the dielectric board 10, electrical installation of the feeder (not shown) which penetrated the dielectric board 10 from the rear-face side to the field-like radiating element 12 is carried out, and the circularly-polarized-wave reception patch antenna 16 which receives the satellite wave of the circularly-polarized wave transmitted from a satellite with the field-like radiating element 12 and the grand plate 14 is constituted. Moreover, the perpendicular linearly polarized wave receiving-antenna element 18 which protrudes up, is constituted including a helical coil and receives the ground wave of a perpendicular linearly polarized wave is arranged in the center position of the field-like radiating element 12. In addition, the perpendicular linearly polarized wave receiving-antenna element 18 is in an insulating condition in the field-like radiating element 12.
[0004] the directional characteristics of the conventional compound antenna of this configuration -- drawing 10 thru/or drawing 12 -- like -- it comes out. Drawing 10 is directional-characteristics drawing within a vertical plane which received the satellite wave with the circularly-polarized-wave reception patch antenna 16. Drawing 11 is directional-characteristics drawing within a vertical plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element 18. Drawing 12 is directional-characteristics drawing within a horizontal plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element 18.
[0005]
[Problem(s) to be Solved by the Invention] If it is in the conventional compound antenna shown in drawing 9 , as shown in drawing 12 , the directional characteristics within a horizontal plane show indirectivity to the ground wave. Moreover, although not illustrated, of course, the directional characteristics within a horizontal plane show indirectivity to a satellite wave. However, as shown in drawing 10 , gain falls, so that perpendicular upper gain is the largest and an elevation angle becomes low to a satellite wave. This will produce change in receiving sensitivity by the posture in which a compound antenna is installed by the location to receive again etc. And as shown in drawing 11 , gain [in / to a ground wave / a horizontal low elevation angle] is small. In order to obtain good receiving sensitivity to a ground wave, it is desirable for

the gain of a horizontal low elevation angle to be large.
[0006] It aims at offering the compound antenna which has improved so that there may be little change of gain, gain may be [this invention may be made in view of the situation of the conventional technology like ****, it may be a thing] large by the difference of an elevation angle to a satellite wave also at a low elevation angle again and the gain of a low elevation angle may become [as opposed to / further / a ground wave] larger.
[0007]
[Means for Solving the Problem] In order to attain this purpose, a compound antenna of this invention It is the compound antenna which receives a satellite wave of a circularly-polarized wave, and a ground wave of a perpendicular linearly polarized wave. A drill-like radiating element is arranged in the surface of a fixed dielectric member centering on top-most vertices of the shape of said drill. the upper part -- a convex -- the shape of a drill -- thickness -- abbreviation -- A circularly-polarized-wave reception patch antenna which arranges a grand plate in a rear face of said dielectric member, connects a feeder to said drill-like radiating element, and can receive said circularly-polarized wave on said drill-like radiating element and grand plate is formed. A perpendicular linearly polarized wave receiving-antenna element which protrudes on top-most vertices of the shape of said drill of said dielectric member up, and can receive said perpendicular linearly polarized wave is arranged in the state of said drill-like radiating element and an insulation, and it is constituted.
[0008] And said dielectric member may be made into the shape of a cone, said conic drill-like radiating element may be arranged in the surface, and said perpendicular linearly polarized wave receiving-antenna element may be constituted including a helical coil.
[0009] Moreover, said dielectric member is penetrated to said drill-like radiating element from said grand plate side, electrical installation of the central conductor of the 1st coaxial structure as said feeder is carried out to it, electrical installation of the outer conductor of said 1st coaxial structure is carried out to said grand plate, electrical installation of the end face of said perpendicular linearly polarized wave receiving-antenna element is carried out to a central conductor of the 2nd coaxial structure, electrical installation of the outer conductor of said 2nd coaxial structure can be carried out to said grand plate, and it can also be constituted.
[0010]
[Embodiment of the Invention] Hereafter, the 1st example of this invention is explained with reference to drawing 1 thru/or drawing 6 . Drawing 1 is the external view of the 1st example of the compound antenna of this invention, (a) is a plan and (b) is a side elevation. Drawing 2 is the A-A cross-section view enlarged view of (a) of drawing 1 . Drawing 3 is directional-characteristics drawing within a vertical plane which received the satellite wave with the circularly-polarized-wave reception patch antenna. Drawing 4 is directional-characteristics drawing within a vertical plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element. Drawing 5 is directional-characteristics drawing within a horizontal plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element. Drawing 6 is the drawing of longitudinal section which held the compound antenna of drawing 1 in the antenna hold case.
[0011] if it is in the compound antenna of this invention -- the upper part -- a convex -- the shape of a cone -- thickness t -- abbreviation -- the conic cone-like radiating element 22 which consists of an electric conduction metal plate, an electric conduction metal thin film, etc. is arranged in the surface of the fixed dielectric member 20. The cone-like radiating element 22 is arranged centering on the top-most vertices of the dielectric member 20, and the top-most vertices are in agreement. And the notching-like perturbation elements 22a and 22a are formed in two places which counter the edge of the cone-like radiating element 22 at a radial. Moreover, the grand plate 24 which consists of an electric conduction metal thin film etc. all over the rear-face abbreviation for the dielectric member 20 is arranged. Furthermore, central conductor 26a of the 1st coaxial track 26 penetrates the dielectric member 20 from a rear-face side, and electrical installation is suitably carried out to the cone-like radiating element 22 in the surface by soldering 28 etc. Moreover, electrical installation of the outer-conductor 26b of the 1st coaxial track 26 is suitably carried out to the grand plate 24 by soldering etc. It has and a conic

circularly-polarized-wave reception patch antenna is formed with the cone-like radiating element 22 and the grand plate 24 which were prepared on both sides of the dielectric member 20. In addition, the vertical angle is 125 degrees and the size from top-most vertices to an edge of the cone-like radiating element 22 for receiving the satellite wave of the 2.3GHz circularly-polarized wave of the transmit frequencies of the XM Satellite Radio broadcast as an example is 25mm. What the dimension to the received frequency of this cone-like radiating element 22 should be suitably set up for with the dielectric constant of the dielectric member 20 is natural.
[0012] Furthermore, the perpendicular linearly polarized wave receiving-antenna element 30 which protrudes up and by which its helical-coil section 30a and end face side is set to bay 30b is arranged in the conic top-most vertices of the dielectric member 20. Bay 30b penetrates the top-most vertices of the dielectric member 20 perpendicularly, and electrical installation is carried out to central conductor 32a of the 2nd coaxial track 32 established in a rear-face side. Electrical installation of the outer-conductor 36b of this 2nd coaxial track 32 is suitably carried out to the grand plate 24 of the rear face of the dielectric member 20 by soldering etc. In addition, this perpendicular linearly polarized wave receiving-antenna element 30 is made into the condition of having been insulated to the cone-like radiating element 22. And an upper portion acts as an antenna from the grand plate 24, and as an example, the perpendicular linearly polarized wave receiving-antenna element 30 is set as electric merit with a quarter-wave length [of the transmit frequencies of broadcast] of 2.3GHz so that it may be made to resonate.
[0013] the directional characteristics within a vertical plane received by the cone-like radiating element 22 to the satellite wave as shown in drawing 3 if it was in the compound antenna of this invention of this configuration -- from the perpendicular upper part up to the low elevation angle of **70 degrees of abbreviation -- receiving sensitivity -- about 5dB and abbreviation -- even if it is the same and is moreover in a **90-degree low elevation angle, as compared with the conventional compound antenna indicated to be -5dB to drawing 10 , gain is improving about 3dB of abbreviation. Then, there is little change of receiving sensitivity by the posture in which the compound antenna of a location or this invention which receives this is installed to a satellite wave. And the receiving sensitivity in a low elevation angle is improving. It has and a satellite wave can be received certainly. In addition, although the directional characteristics within a horizontal plane over a satellite wave are not illustrated, they are natural. [of it being indirectivity]
[0014] And as shown in drawing 4 , as compared with the conventional compound antenna indicated to be about 1dB to drawing 11 in a **90-degree low elevation angle, gain of directivity on vertical plane which received by the perpendicular linearly polarized wave antenna element 30 is improving about 3dB of abbreviation to a ground wave. Thereby, improvement in receiving sensitivity can be aimed at about 3dB of abbreviation to the ground wave.
[0015] Although it is thought here that the gain of a **90-degree low elevation angle is improved by making this reflecting plate into the shape of a cone with a small vertical angle since the cone-like radiating element 22 acts as a reflecting plate to the perpendicular linearly polarized wave antenna element 30 Even if it only decreases the vertical angle of the cone-like radiating element 22 from 180 degrees, the gain of the **90-degree low elevation angle of the perpendicular linearly polarized wave antenna element 30 does not improve uniformly, and an increment and reduction arise by turns. Then, artificers have set the vertical angle of the cone-like radiating element 22 as a reflecting plate as 125 degrees by experiment.
[0016] As shown in drawing 6 , the compound antenna of this invention like **** is held in an antenna hold case, so that it can carry in the roof of a vehicle etc. as an example. In drawing 6 , the circuit board 40 is arranged in the base side of the dielectric member 20, the low noise amplifying circuit (not shown) which amplifies a satellite wave and a terrestrial input signal is carried in this circuit board 40, electrical installation of the other end of the 1st and the 2nd coaxial track 26 and 32 is suitably carried out to the circuit board 40, and an input signal is inputted into a low noise amplifying circuit. And the amplification output of this low noise amplifying circuit is drawn by the output cable 42. Moreover, the radome 44 which consists of an approximate circle drill-like dielectric is formed so that a compound antenna may be covered from a top, and a pedestal 46 is arranged in the compound antenna bottom. The antenna hold

case 48 which can hold a compound antenna in watertight is constituted by a radome 44 and the pedestal 46. Furthermore, a pedestal 46 may be suitably fixed to the roof of a vehicle by attachment etc.
[0017] Next, the 2nd example of this invention is explained with reference to drawing 7 . Drawing 7 is the appearance perspective diagram of the 2nd example of the compound antenna of this invention. the 2nd example shown in drawing 7 -- the shape of a rectangular-head drill -- thickness -- abbreviation -- the rectangular-head drill-like radiating element 52 which the top-most vertices are made in agreement, and consists of an electric conduction metal plate, an electric conduction metal thin film, etc. is arranged in the surface of the fixed dielectric member 50. And the perpendicular linearly polarized wave receiving-antenna element 30 which the top-most vertices of the dielectric member 50 are made to project up, and contains a helical coil is arranged. In addition, the grand plate which is not illustrated is prepared in the rear face of the dielectric member 50, and electrical installation of the proper feeder is carried out also to the rectangular-head drill-like radiating element 52, and a circularly-polarized-wave reception patch antenna is formed.
[0018] Even if it is in the 2nd example of this invention shown in drawing 7 , improvement in the gain of a low elevation angle can be aimed at [as opposed to / both / a satellite wave and a ground wave] like the 1st example.
[0019] Furthermore, the 3rd example of this invention is explained with reference to drawing 8 . Drawing 8 is the external view of the 3rd example of the compound antenna of this invention, (a) is a plan and (b) is front view. The place which is different from the 1st example in the 3rd example shown in drawing 8 replaces the feeder to the cone-like radiating element 22 with the 1st coaxial track 26, and forms it by the microstrip line 60 which consists of a band-like electric conduction metal thin film prepared in the surface of the dielectric member 20. Of course, the same operation effect as the 1st example is acquired.
[0020] In addition, although the 1st and the 2nd coaxial track 26 and 32 are used in the 1st above-mentioned example, as long as coaxial structure is formed, you may be the thing of what kind of structure. Moreover, like the 1st example, it was not restricted to that by which the cone-like radiating element 22 with a circular plane projection configuration is formed in the surface of the conic dielectric member 20, but one corner of a rectangular (a square and a rectangle are included) thing or a square could cut, and the plane projection configuration could lack. Moreover, like the 2nd example, a plane projection configuration may not be restricted to that in which the rectangular rectangular-head drill-like radiating element 52 is formed on the surface of the rectangular-head drill-like dielectric member 50, but a plane projection configuration may be a circular drill-like radiating element. And the drill-like radiating element arranged in a dielectric member and its surface in the 2nd example may not be restricted to a rectangular-head drill, but may be what kind of pyramids-like, such as a pentagonal pyramid and a hexagon-head drill. Furthermore, dielectric members may be the shape of an elliptic cone, a rectangular rectangular-head drill, etc. The drill-like radiating element prepared in the surface of the dielectric members 20 and 50 may be what kind of patch configuration in which the plane projection configuration can receive a circularly-polarized wave. Furthermore, in the example, the perpendicular linearly polarized wave receiving-antenna element 30 of it being formed including the helical coil, in order to shorten physical length, but your forming with a pole antenna, as long as physical length may be long may be natural, and as long as the directivity within a horizontal plane is an antenna [**** /-less], you may be the thing of what kind of structure.
[0021]
[Effect of the Invention] Since the compound antenna of this invention is constituted as explained above, the following solves and an exceptional effect is done so.
[0022] If it is in a compound antenna according to claim 1, in the low elevation angle of the directional characteristics within a vertical plane which received the satellite wave with the circularly-polarized-wave reception patch antenna, gain is improved for either in the low elevation angle of the directional characteristics within a vertical plane which received the ground wave with the perpendicular linearly polarized wave receiving element by having made into the shape of a drill the radiating element which forms a circularly-polarized-wave reception

patch antenna. And gain is almost fixed to a satellite wave in the large range from the perpendicular upper part to the low elevation angle of **70 degrees of abbreviation. Then, receiving sensitivity does not change with change of the posture of a location or a compound antenna in which this is received etc., sharply to a satellite wave.
[0023] If it is in a compound antenna according to claim 2, since the perpendicular linearly polarized wave receiving-antenna element in which the whole was formed in in the shape of an approximate circle drill, and physical length contained the short helical coil at the top-most vertices is protruded, it is suitable to constitute the whole small.
[0024] If it is in a compound antenna according to claim 3, since the input signal by the circularly-polarized-wave reception patch antenna and the perpendicular linearly polarized wave receiving-antenna element is derived with the 1st and 2nd coaxial structure, the attenuation in the derivation path of an input signal is not produced.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the external view of the 1st example of the compound antenna of this invention, and (a) is a plan and (b) is a side elevation.
[Drawing 2] It is the A-A cross-section view enlarged view of (a) of drawing 1 .
[Drawing 3] It is directional-characteristics drawing within a vertical plane which received the satellite wave with the circularly-polarized-wave reception patch antenna of the compound antenna of this invention.
[Drawing 4] It is directional-characteristics drawing within a vertical plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element of the compound antenna of this invention.
[Drawing 5] It is directional-characteristics drawing within a horizontal plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element of the compound antenna of this invention.
[Drawing 6] It is the drawing of longitudinal section which held the compound antenna of drawing 1 in the antenna hold case.
[Drawing 7] It is the appearance perspective diagram of the 2nd example of the compound antenna of this invention.
[Drawing 8] It is the external view of the 3rd example of the compound antenna of this invention, and (a) is a plan and (b) is front view.
[Drawing 9] It is the perspective diagram of an example of the conventional compound antenna.
[Drawing 10] It is directional-characteristics drawing within a vertical plane which received the satellite wave with the circularly-polarized-wave reception patch antenna of the conventional compound antenna.
[Drawing 11] A ground wave is received with the perpendicular linearly polarized wave receiving-antenna element of the conventional compound antenna, and it is directional-characteristics drawing within a vertical plane.
[Drawing 12] It is directional-characteristics drawing within a horizontal plane which received the ground wave with the perpendicular linearly polarized wave receiving-antenna element of the conventional compound antenna.
[Description of Notations]
14 24 Grand plate
18 30 Perpendicular linearly polarized wave receiving-antenna element
20 50 Dielectric member
22 Cone-like Radiating Element
26 1st Coaxial Track
32 2nd Coaxial Track
52 Rectangular-Head Drill-like Radiating Element
60 Microstrip Line

[Translation done.]

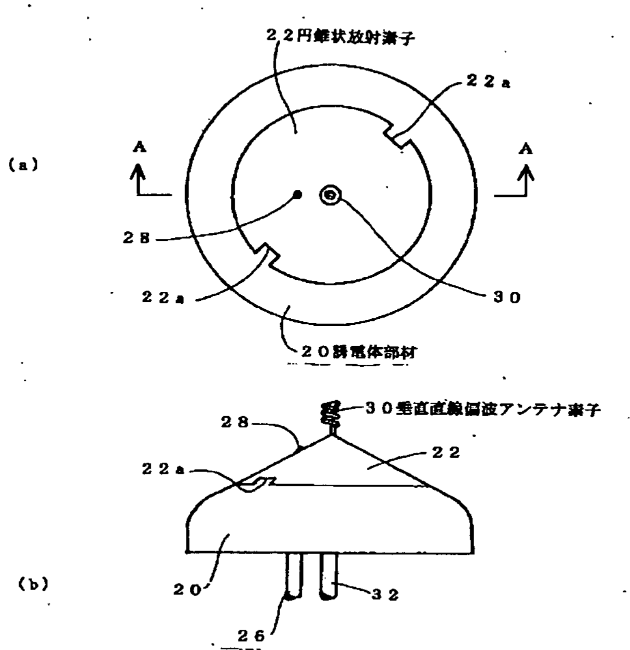
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

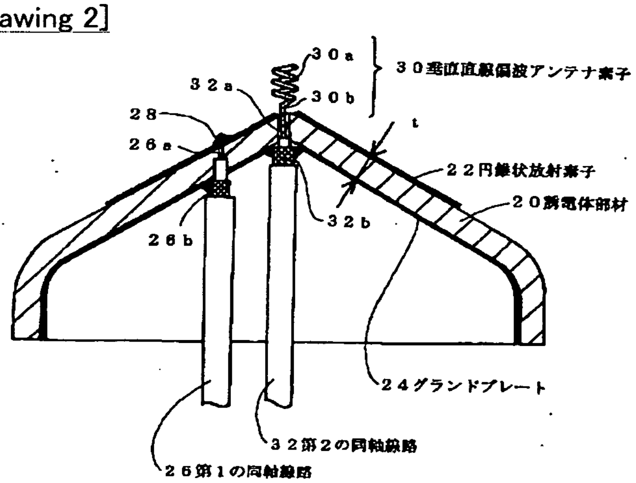
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

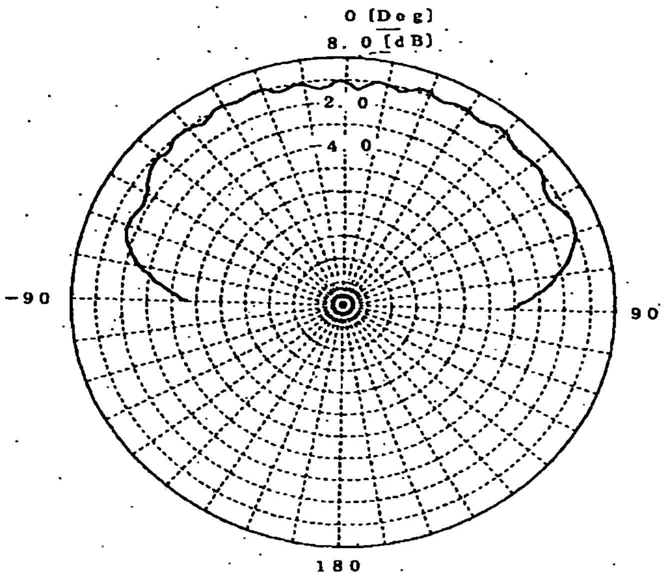
[Drawing 1]



[Drawing 2]



[Drawing 3]



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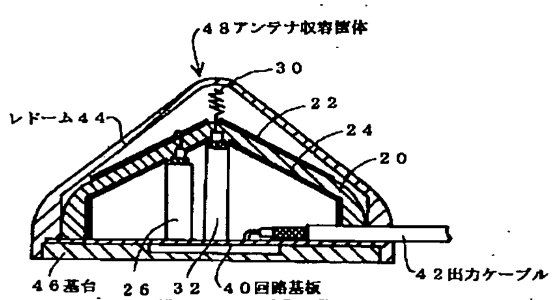
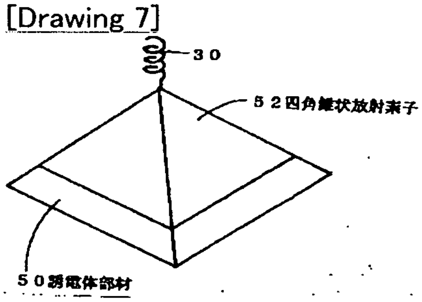


[Drawing 7]



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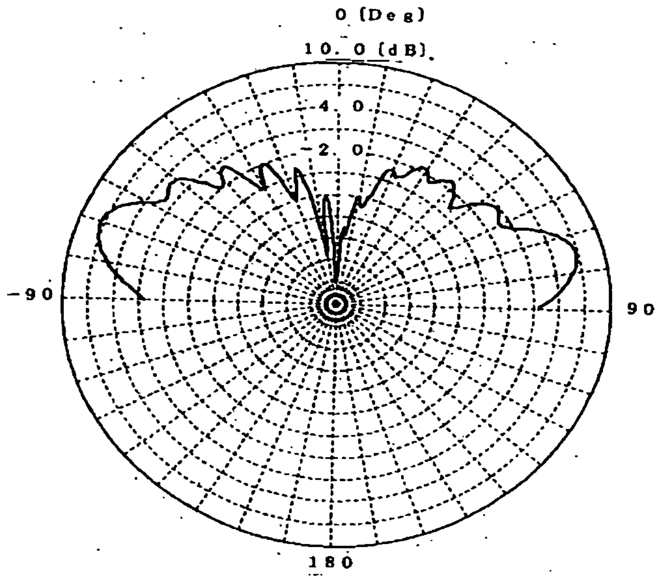

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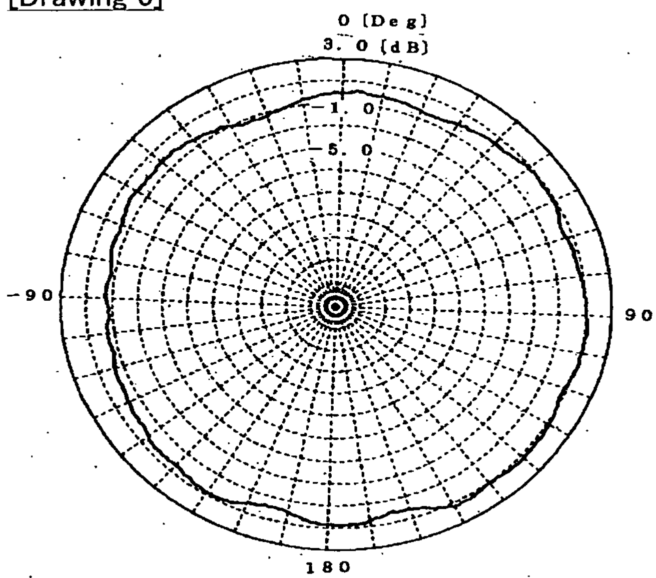

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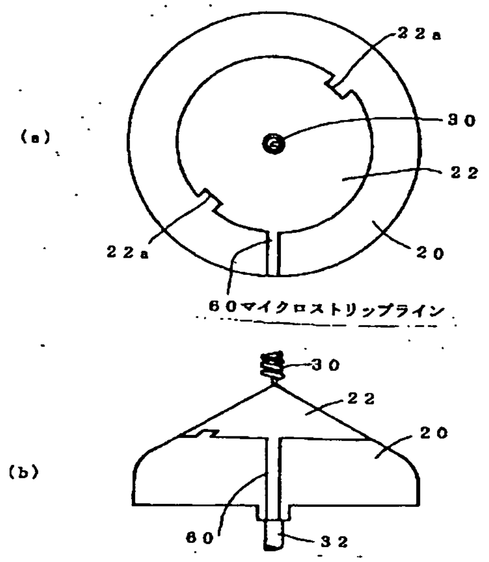
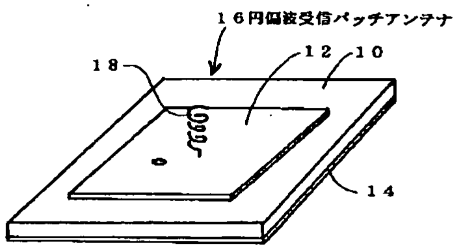
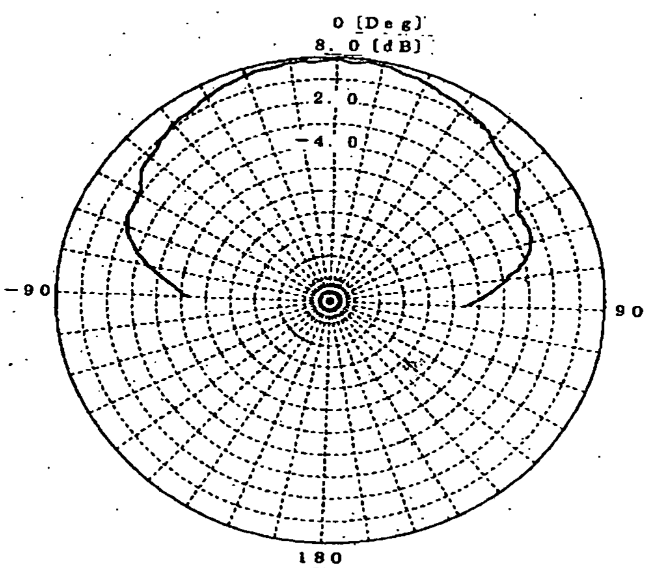


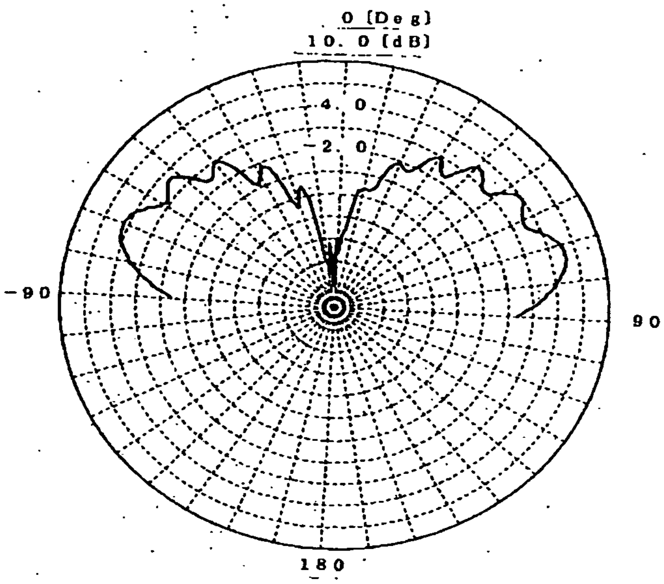
[Drawing 9]



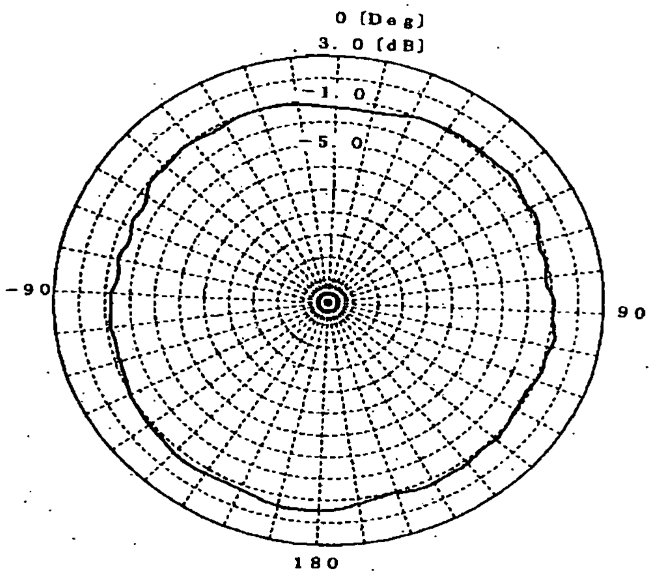
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]